National Aeronautics and
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Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

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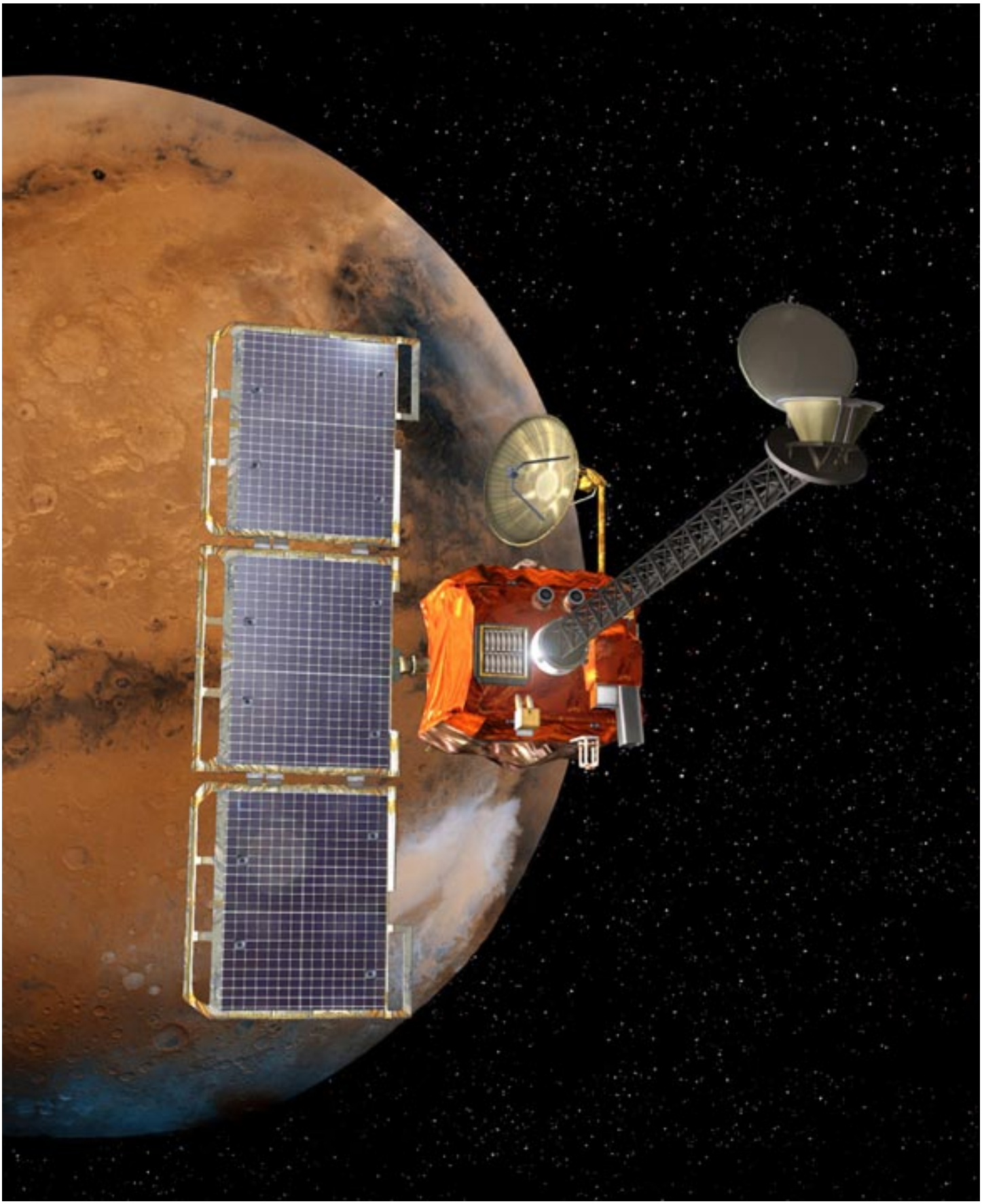

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The surface of Mars is thought to consist of a mixture of rock, soil, and icy material. However, the exact composition of these materials is unknown, except for those at a few locations previously visited by landers. The Mars Surveyor 2001 Orbiter, scheduled for launch about March 30, 2001, carries a set of instruments designed to determine the composition of surface materials, detect shallow buried ice, and study the radiation environment.

Getting into Orbit. The Orbiter will arrive at Mars about October 20, 2001. After firing its main engine to slow itself enough to be captured by Mars' gravity, the Orbiter will initially circle the planet once every 25 hours. Over the next 76 days, the spacecraft will gradually edge closer to Mars, using the friction of the atmosphere to lower its orbit (a technique called aerobraking) until it reaches a two-hour science orbit. Without aerobraking, the spacecraft would need to carry much more fuel. In addition to its science observations, the 2001 Orbiter will support communication with the 2001 Lander, which is scheduled to arrive about January 22, 2002.

The Orbiter's three science instruments are a Gamma-Ray Spectrometer, a Thermal Emission Imaging System, and the Mars Radiation Environment Experiment.

Water Ice and Elements. The Gamma-Ray Spectrometer (GRS) will determine the abundance of major elements at the surface of the planet, such as oxygen, iron, silicon, and aluminum. The GRS can measure the amount of hydrogen, and therefore water ice, in the upper meter of the soil across the entire planet. This should help scientists determine the amount of water that exists on the planet — a key resource for any future human explorers and also a clue to Mars' climate history. GRS data also will help scientists determine the thickness of the seasonal polar ice deposits as they grow and shrink each year.

The GRS will shed more light on how Mars formed. The ratio of certain key elements — for example, potassium and thorium — when compared to the solar ratio from which our solar system formed will tell scientists much about the planet's early history. Results from Mars Pathfinder suggest that some rocks on Mars may be richer in the element silicon than previously thought.

The GRS will be able to search the entire planet for silicon-rich rocks, providing information on the composition and evolution of the Martian interior. Finally, because the GRS is very sensitive to elements such as sodium, potassium, and chlorine, it will be possible to see if salts have been deposited in areas thought to be dry lakebeds or ancient ocean bottoms.

Minerals and Temperature. The Thermal Emission Imaging System (THEMIS) will collect images that will be used to identify the minerals present in the soils and rocks at the surface. THEMIS will support mineral mapping by the Thermal Emission Spectrometer (TES) instrument on the Mars Global Surveyor spacecraft — already at Mars — by observing at the same infrared wavelengths but with finer detail.

THEMIS will also study small-scale geologic processes and landing site characteristics by imaging the shape of the landscape and determining the characteristics of rocks, dust, sand, and soils. THEMIS will search for hydrothermal areas (for example, like the ones in Yellowstone National Park in Wyoming) and dry lakebeds. THEMIS will also search for temperature differences due to heat that may be coming from active volcanic areas or hot springs.

Radiation Environment. The Mars Radiation Environment Experiment (MARIE) will collect data on the radiation environment in space near Mars to help assess potential risks to any future human explorers. Along with a similar instrument on the 2001 Lander, MARIE will determine the effects of the atmosphere on radiation hazards on the surface.

The Mars Exploration Program is managed for NASA's Office of Space Science by the Jet Propulsion Laboratory, California Institute of Technology. JPL's industrial partner is Lockheed Martin Astronautics. Scientific instruments will be operated by principal investigators from the University of Arizona, Arizona State University, and NASA Johnson Space Center.

Join us as we explore Mars! Log on to *http://mars.jpl.nasa.gov* to learn the latest news in these historic journeys of adventure.

Points to ponder for educators and students: Why is it important to understand what rocks on Mars are made of? Why do things look different in different wavelengths? Why can't our own eyes see in these different wavelengths? Are we exposed to radiation on Earth? Is it harmful?

Please take a moment to evaluate this product at ehb2.gsfc.nasa.gov/edcats/lithograph. *Your evaluation and suggestions are vital to the continual improvement of NASA's educational materials. Thank you.*

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